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BULLETIN
OF THE
New York State Museum

FREDERICK J. H. MERRILL *Director*

No. 37 Vol. 8

September 1900

ILLUSTRATED DESCRIPTIVE CATALOGUE
OF SOME OF THE MORE IMPORTANT
INJURIOUS AND BENEFICIAL INSECTS
OF
NEW YORK STATE

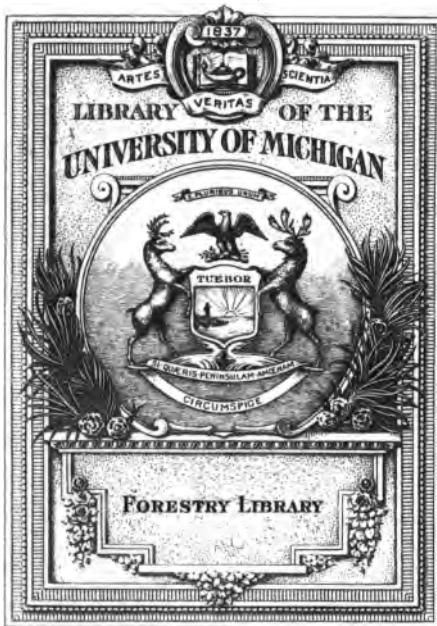
BY
EPHRAIM PORTER FELT D.Sc.
State entomologist

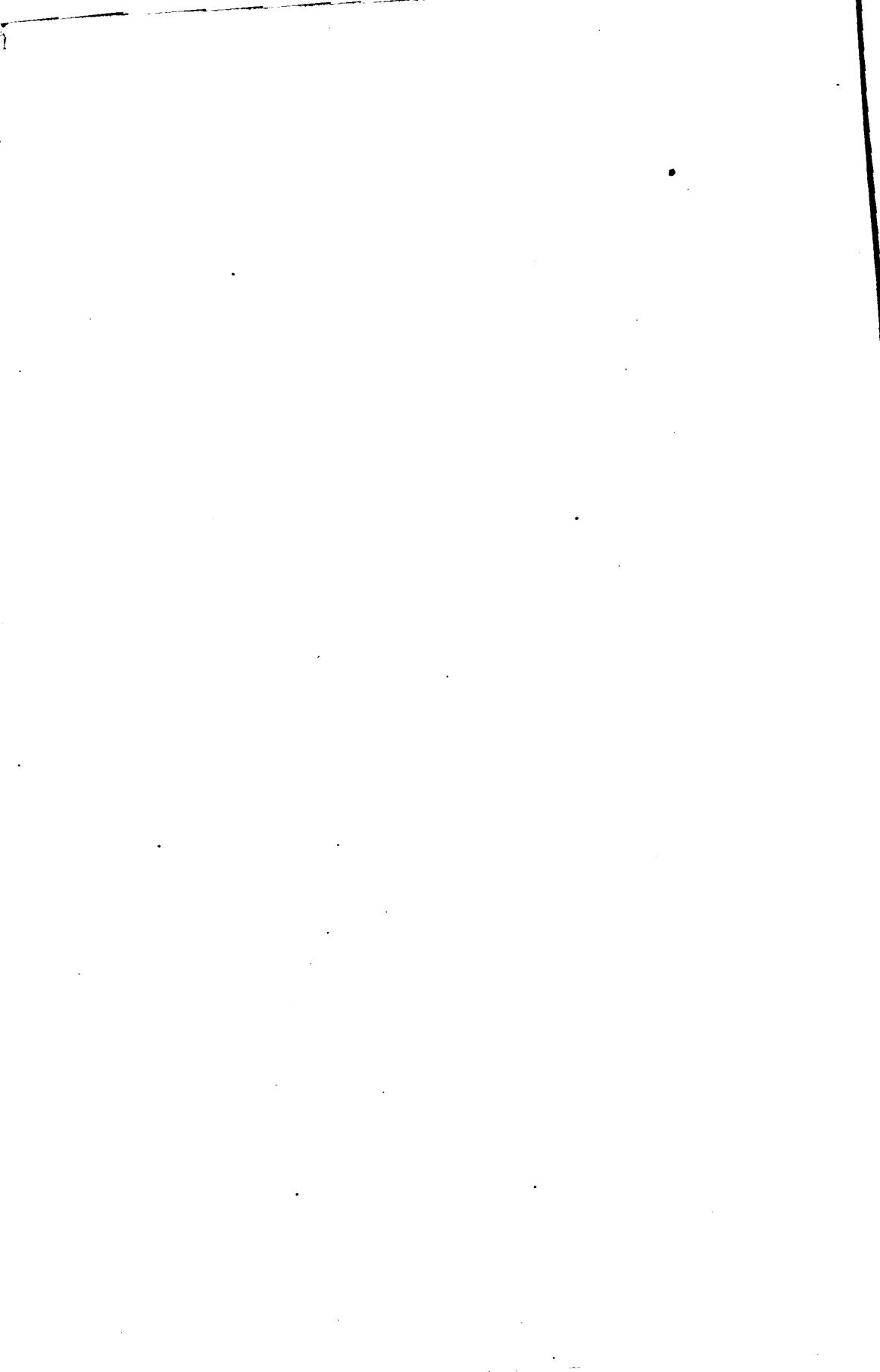
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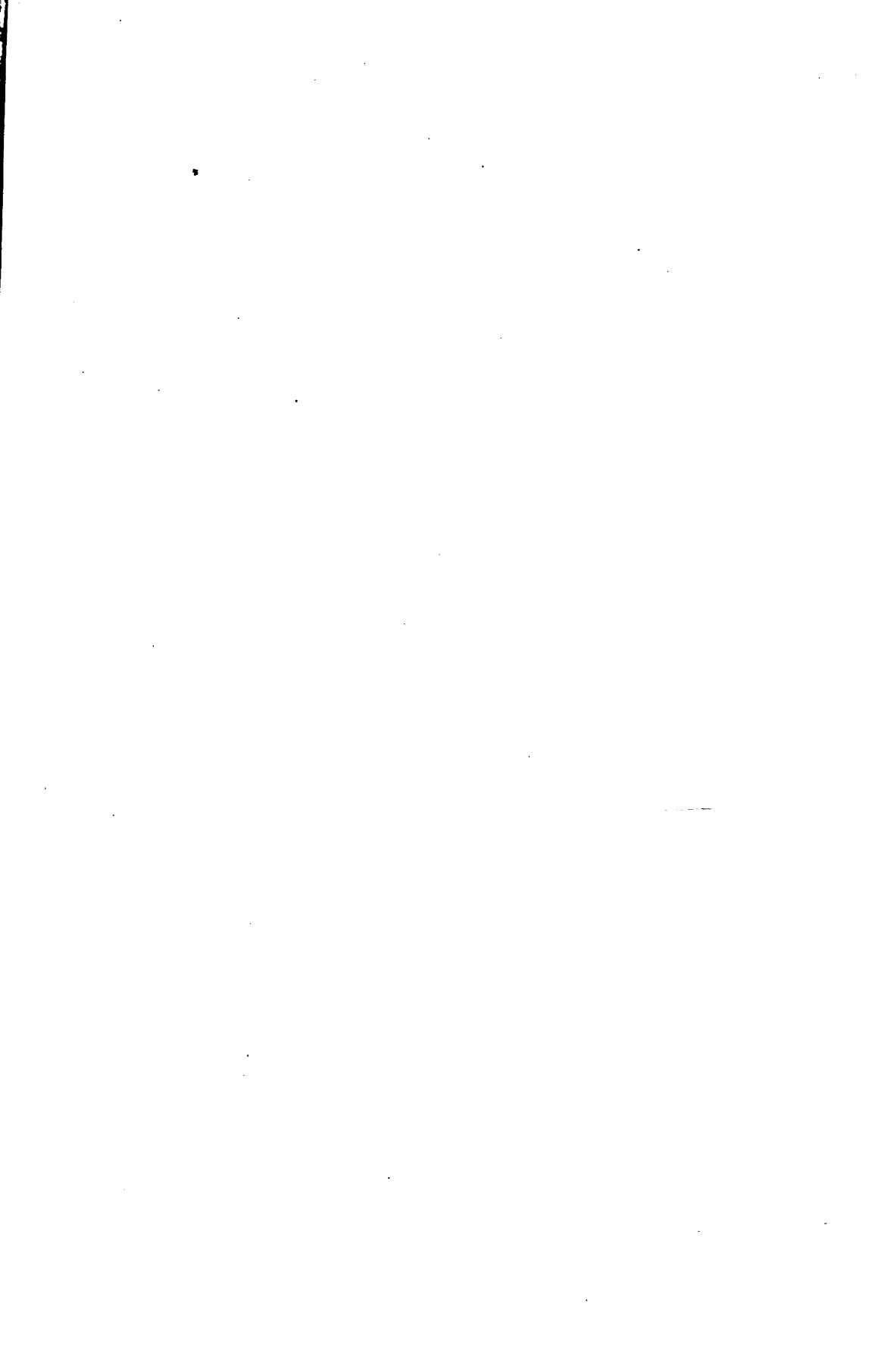
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This catalogue by no means includes all the injurious insects attacking the classes of plants listed. It gives the more important characteristics of the insects represented in a collection prepared for exhibition at farmers institutes, granges, fairs and other gatherings where it might be advisable to make such a display. The species have also been represented by figures so far as the means at hand would permit. Many of the illustrations have been borrowed from other works, and a few have been made specially for this catalogue.

STAFF

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Assistants



INJURIOUS AND BENEFICIAL INSECTS FRUIT TREE INSECTS

1 Apple tree tent-caterpillar (*Clisiocampa americana*). The conspicuous web tents found in the forks of apple and cherry trees in May contain hairy, bluish black caterpillars marked with yellowish and with a white stripe along the back. The cocoons are spun the last of May, the light brown moths, with oblique white stripes across the fore wings, flying in June. The eggs, in belts incircling the smaller twigs, are covered with a brown, glistening protective substance and remain unhatched till spring.

Treatment: remove and destroy the eggs or crush the young in their nests. Spray the foliage of infested trees with poison in early spring.

2 Codling-moth (*Carposina pomonella*). Familiar as the worm boring in apples near the core. The winter is passed by the caterpillar in small cavities under sheltering bark or in crevices.

The moths appear shortly after the petals fall. There are usually two broods a year in New York state.

Treatment: band trees and kill worms collecting under the bands, destroy wormy apples, spray with poison shortly after the petals have fallen, and while the calyx lobes are still open. Prevent escape of the moths in the

spring from fruit cellars or storehouses.

3 Palmer worm (*Ypsolophus pomellus*). Small wriggling, yellowish green caterpillars, having a dark stripe on

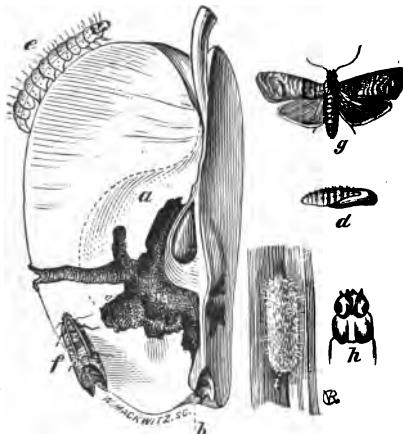


FIG. 2 Codling-moth: a burrow of larva; b point of entrance of larva; c pupa; d full-grown larva; e adult moth at rest; f same with wings spread; g head of full-grown larva (after Riley)



FIG. 1 Egg belt of apple tree tent-caterpillar, enlarged

either side and ornamented with rather conspicuous dark tubercles, were very numerous the latter part of June and early July in many orchards, where they skeletonized the leaves and ate large holes in the young fruit. The parent insect emerges from a slender brown pupal case and is a delicate, grayish moth.

Treatment: spray thoroughly in early June with poison.

4 **Pistol case-bearer (*Coleophora malivorella*).** Small caterpillars in pistol-shaped cases feed from April to May on the

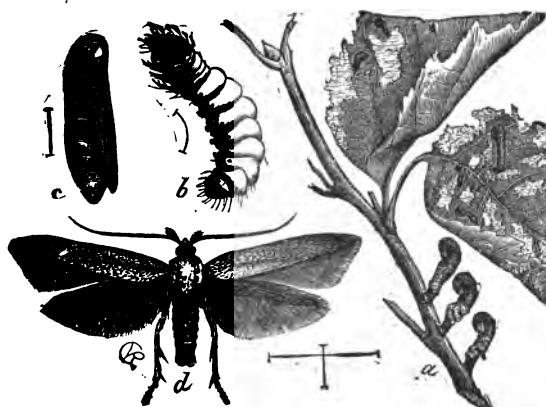


FIG. 3 Pistol case-bearer: a cases containing the larvae, natural size; b larva; c pupa; d moth; b, c and d enlarged (after Riley)

part of July. The winter is passed by the caterpillars within cases securely attached to the bark.

Treatment: spray infested trees with the poison just as the buds are opening, and repeat, if necessary, a few days to a week later.

5 **Cigar case-bearer (*Coleophora fletcherella*).** Small caterpillars in cigar-shaped cases feed from April to June on the buds and foliage of apple trees. The delicate, gray moths appear from the middle of June to the middle of July, lay eggs, which hatch in about two weeks, the young being leaf-miners. The caterpillars soon make cases, later attach them securely to the bark, pass the winter therein, and begin feeding again in early spring.

Treatment: spray infested trees with poison just as the buds are opening, and repeat, if necessary, a

opening flowers and young leaves of the apple tree, often skeletonizing the latter. The dark drab colored moths appear the latter part of June, deposit eggs and the young emerge therefrom the latter



FIG. 4 Cigar case-bearer on bit of leaf—four times natural size (original)

few days to a week later. Kerosene emulsion is also effective, if applied at this time.

6 Bud moth (*Tmetocera ocellana*). Small brown caterpillars about $\frac{1}{2}$ inch long, with black head and thoracic shield, are frequently found eating the young leaves and flowers of apple and pear tree. The parent moth is an inconspicuous, grayish insect. The winter is passed by the half-grown caterpillars within almost invisible cocoons attached near a bud or rough place in the bark.



FIG. 5 Eye-spotted bud moth and its caterpillar

Treatment: spray thoroughly with poison as the buds begin to open.

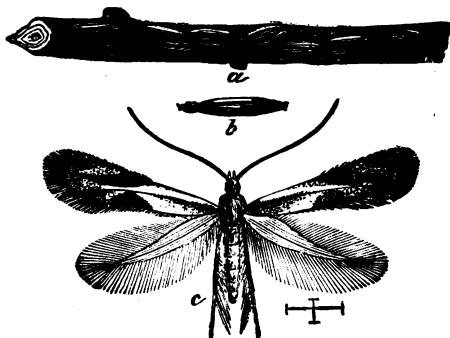


FIG. 6 Apple leaf *Bucculatrix*: a cocoons on twig; b cocoon enlarged; c moth enlarged

and brown. The small larvae mine the leaves and later feed externally. There are two broods annually.

Treatment: spray infested foliage with poison in early June.

8 Rose beetle (*Macrodactylus subspinosus*). Greenish yellow beetles about $\frac{1}{2}$ inch long appear in swarms in May and attack the foliage of various trees and vines. The young are white grubs and live under ground on grass and the roots of other plants. This insect occurs most abundantly on a sandy soil.

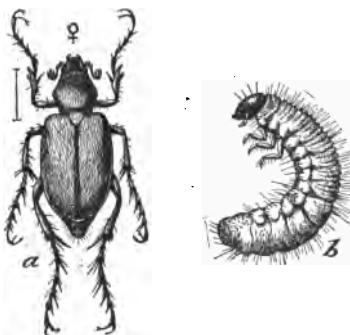


FIG. 7 Rose beetle: a adult beetle; b larva (reduced after Marlatt. U. S. dep't agr., Year-book 1895)

Treatment: spray beetles with $\frac{1}{2}$ pound whale oil soap to 1 gallon water, dust vines with ashes, etc.; handpicking.

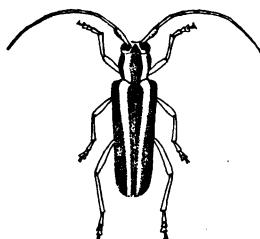


FIG. 8 Apple tree borer, adult beetle

9 **Apple tree borer** (*Saperda candida*). The presence of this insect is usually indicated by "saw-dust" or diseased bark and beneath the latter, legless, white, round headed borers are found. The brown beetles, striped with white, about 1 inch long, occur from June to August. Two or three years are required to complete the life cycle.

Treatment: protect base of tree with wire netting. Dig out the young borers in the fall. Cut and burn badly infested trees.

10 **Pear midge** (*Diplosis pyriavora*). The dwarfed, deformed, infested fruit drops early, and within occur thick bodied, pale yellow maggots. The parent midge appears about the time the trees are in bloom and deposits her eggs. The young grow rapidly and cause a distortion of the fruit, which usually cracks with the first good rain about June 1. The larvae then enter the ground and pupate.

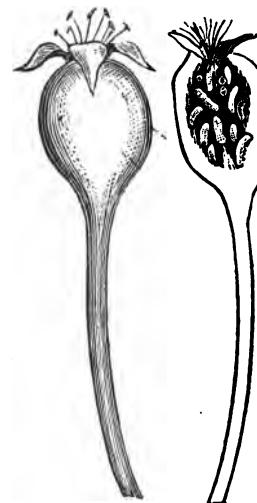


FIG. 9 Pear midge. Section of pear containing the larvae, and an uninfested one for comparison of forms



FIG. 10 Burrows of peach bark borer in a young apple tree

Treatment: destroy infested fruit.

11 **Peach bark borer** (*Scolytus rugulosus*). The bark of affected

trees is punctured with many small, circular holes, made by brownish black beetles less than $\frac{1}{8}$ inch long. The inner portions of the bark and sap wood are frequently filled with burrows. The parent beetles enter the bark and make burrows, on either side of which eggs are deposited, and the young work away from the main burrow. There are probably two broods annually in New York state.

Treatment: burn badly infested trees. Apply carbolic soap wash to trunks and limbs in early spring.

12 **Pear blight beetle** (*Xyleborus dispar*). The bark of affected trees is punctured with many small, circular holes made by dark brown beetles about $\frac{1}{8}$ inch long. Inner portions of the bark and sap wood are filled with burrows.

Treatment: burn badly infested trees.

13 17 year cicada (*Cicada septendecim*). Slit and broken twigs with wilting leaves are characteristic of the work of this insect, but unless the trees are small not much damage is done. Broods appear at intervals of 17 years. The adult may be distinguished from the dog day cicada by its bright red eyes and wing veins of the same color.

Prevention: avoid setting out trees in last few years before cicadas are due.

14 **Apple tree bark louse** (*Mytilaspis pomorum*). Bark infested with elongated brownish scales shaped somewhat like oyster shells. The winter is passed as white eggs under old scales, the young appear about June 1. A common scale insect which sometimes occurs in large numbers, and infests many different shrubs and trees.

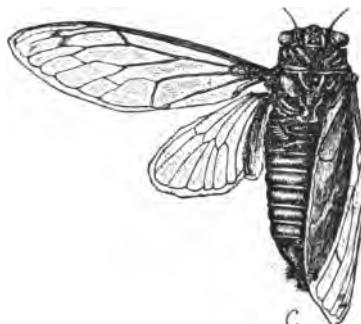


FIG. 11 17 year cicada

Treatment: spray young with kerosene emulsion or whale oil soap solution.

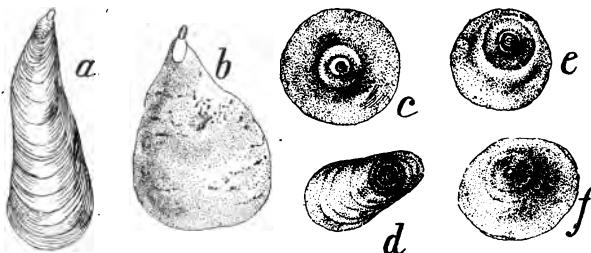


FIG. 12 Scale insects: *a* apple tree bark louse; *b* scurfy bark louse; *c* San José scale; *d* male of same; *e* English oyster scale; *f* Putnam's scale (original)

15 **Scurfy bark louse** (*Chionaspis furfur*us). The whitish, scurfy scales occur on the bark of fruit trees. The purplish eggs remain under the old scales all winter, the young appearing about June 1. A widely distributed scale insect which is sometimes so abundant as literally to coat the trunk of a tree and give it the appearance of having been whitewashed. It is confined largely to fruit trees.

Treatment: spray young with kerosene emulsion or whale oil soap solution.

16 **San José scale** (*Aspidiotus perniciosus*). A small circular scale with a central nipple. It is not readily seen unless very abundant. Infests many trees and shrubs. The specimens show variations in the appearance of the scales and how it may be disseminated by budding. The young appear from early June till cold weather. A very prolific and dangerous species.

Treatment: destroy badly infested trees, specially if young, and spray others thoroughly with 20% mechanical emulsion of crude petroleum just before the buds start in the spring. Kerosene emulsion or whale oil soap solution may be used in the same way, but neither has proved equally effective. The last two are recommended for summer treatment from the time the young appear, using 10% kerosene emulsion or whale oil soap at the rate of 1 pound to 4 gallons of water, and applying at intervals of about 10 days till the middle of September. Small trees can be fumigated with hydrocyanic acid gas with excellent results, using 1

pound of cyanide of potassium to 150 cubic feet of space and treating before the buds start in the spring.

17 **English oyster scale** (*Aspidiotus ostreaeformis*). This resembles the San José scale in appearance, but has the nipple a little to one side of the center, and like it infests fruit trees. It occurs in many localities in this state and should be guarded against as occasionally it is found in great numbers.

Treatment: spray infested trees with a 20% crude petroleum emulsion before the buds start or with kerosene emulsion or whale oil soap solution when the young appear in June. Fumigate with gas.

18 **Putnam's scale** (*Aspidiotus ancylus*). Resembles the two preceding species, but is less injurious. It attacks various trees. The young appear the latter part of June.

Treatment: same as preceding.

SMALL FRUIT AND VINE INSECTS

19 **Currant worm** (*Pteronus ribesii*). Greenish, black dotted saw fly larvae feeding on currant leaves in May, the common currant worm. The parent insect, a small, brownish, black-headed, four winged fly, appears the latter part of April, deposits eggs along the veins on the under side of the leaf. A second brood of flies occurs the last of May or in June.

Treatment: spray with hellebore or poison.



FIG. 13 Immature currant worms (after Saunders)

20 **Currant span worm** (*Diastictis ribearia*). Yellowish, black dotted span worms feeding on leaves in May and June. These are true caterpillars, and are easily distinguished from the preceding species by their "looping" habit when walking. The

parent insect is a delicate, yellowish moth with rather faint, dark markings.



FIG. 14 Currant span worms, larvae and pupa (after Saunders)

hornet. The *Janus* is a black, four winged, slender fly, the female having the abdomen banded with red, the male with his abdomen all reddish. The *Tenthredo* is a heavier, black, four winged fly.

Treatment: burn stems infested with seians and the wilting tips infested by the others.

22 **Raspberry gouty gall beetle** (*Agrilus ruficollis*). The irregular swellings on canes are produced by larvae of this pest. The parent insect is a small black beetle with a bronze colored collar. The grub is a slender, flat headed borer.

Treatment: cut and burn infested canes during winter or early spring.

23 **Light-loving grape vine beetle** (*Anomala lucicola*). Brownish or black beetles about $\frac{3}{8}$ inch long, resembling a small

Treatment: spraying with poison, or handpicking.

21 **Currant stem-borers** (*Sesia tipuliformis*, *Janus integer*, *Tenthredo rufopectus*). The caterpillars boring in the woody stems are seians. The maggots working in the tender tips may be either those of *Janus* or of *Tenthredo*. The parent of the stem-borer is a delicate, clear winged moth much resembling a



FIG. 15 Raspberry gouty gall (after Riley)

June beetle. Occurs in immense numbers occasionally, and then it fairly riddles grape leaves.



FIG. 16 Light-loving grape vine beetle (after Glover)

Treatment: dust vines with lime. Collect and destroy beetles.

24 Spotted grape vine beetle (*Pelidnota punctata*). A large, yellowish brown, black spotted beetle about 1 inch long, resembling a

June beetle. Its size and beauty attract considerable attention, though the insect is rarely abundant enough to do much damage. The larva is one of the white grubs, and lives in decaying roots and stumps of various trees.

Treatment: handpicking.

25 Grape vine flea beetle (*Haltica chalybea*). Greenish or blue jumping beetles about $\frac{1}{8}$ inch long, feeding on buds, or brownish, black dotted larvae about $\frac{1}{2}$ inch long, skeletonizing leaves. The beetles pass the winter in crevices of bark, appearing with warm weather, ready to attack the opening buds. This early feeding by the adults causes the most injury and should be vigilantly guarded against. The grubs begin their work about the latter part of May.

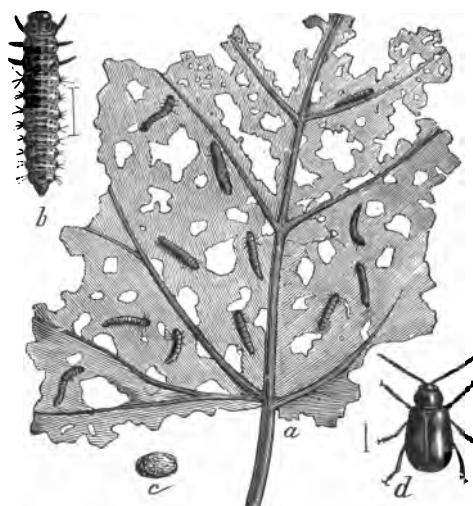


FIG. 18 Grape vine flea beetle: a grubs working; b grub magnified; c earthen cell of pupa; d adult beetle (after Riley)

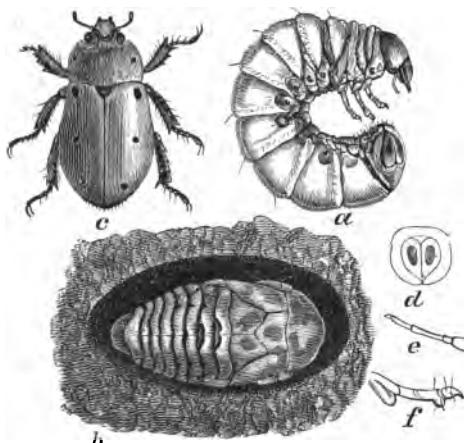


FIG. 17 Spotted grape vine beetle: a larva; b pupa; c adult beetle; d, e, f minor parts strongly magnified (after Riley)

Treatment: the grubs are easily controlled by spraying with poison, and, if this be done, there will be fewer beetles to fight in the spring. Early injury by the beetles may also be prevented by spraying the buds thoroughly, using one pound of poison to 75 gallons of water, or by hand picking.



FIG. 19 Grape vine plume moth: a larva; b pupa; d moth; c and e minor parts enlarged (after Riley)

parent insect is a beautiful black moth marked with eight yellow spots on the wings and with handsome orange tufts on the forward and middle pairs of legs.

Treatment: handpicking; spray with poison.

28 White flower cricket (*Oecanthus niveus*). Series of punctures in twigs of of various kinds are made by this insect for the reception of its eggs. The injury is usually too little to call for remedial measures, specially as the insects are predaceous and beneficial, and should therefore be protected.

26 Grape vine plume moth (*Oxyptilus periscelidactylus*). Small, greenish, hairy caterpillars webbing together terminal leaves. The caterpillars' work is most apparent the last of May or early June, and when abundant they may cause considerable injury. The delicate, brownish, plume moths appear about the middle of June.

Treatment: pick and destroy infested tips.

27 Eight spotted forester (*Alypia octomaculata*). Reddish, black-ringed caterpillars about $1\frac{1}{2}$ inches long feeding on grape vine and Virginia creeper in spring. The

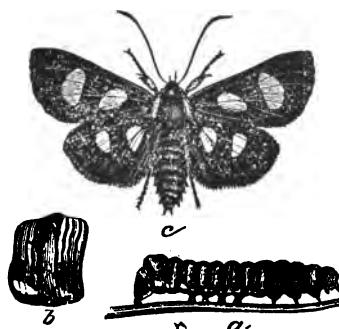


FIG. 20 Eight spotted forester: a caterpillar; b enlarged segment of the same; c female moth

SHADE TREE PESTS

29 **White-marked tussock moth** (*Notolophus leucostigma*). Beautiful caterpillars having three black plumes, four yellow or white tufts, a coral red head, and body marked with black and yellow, defoliate horse chestnut, elm and other shade trees. The winter is passed in egg masses covered with a white, frothy substance, the caterpillars hatching the latter part

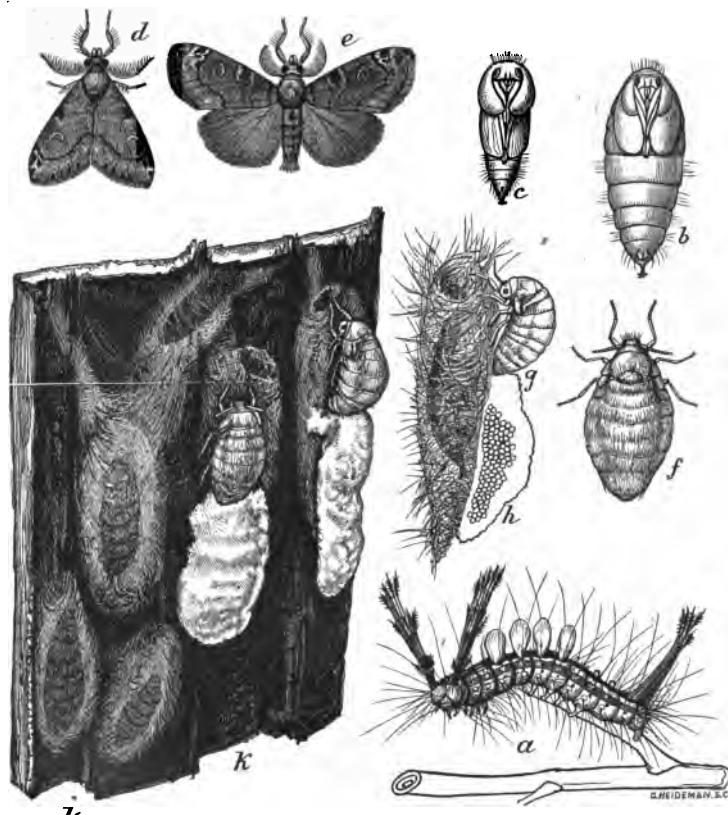


FIG. 21 White marked tussock moth: a larva; b female pupa; c male pupa; d, e male moth; female moth; f same ovipositing; g egg mass; i male cocoons; k female cocoons, with moths laying eggs—all slightly enlarged (after Howard, U. S. dep't agr., Yearbook 1895)

of May and spinning up about a month later, the moths appearing in July. Two broods occur about New York city and but one farther north as a rule.

Treatment: remove and destroy the eggs or spray the foliage of the infested trees with poison.

30 Forest tent-caterpillar: maple worm (*Clisiocampa disstria*). Foliage of maple and fruit trees eaten in May and June by hairy blue headed caterpillars with silvery dots along the back.

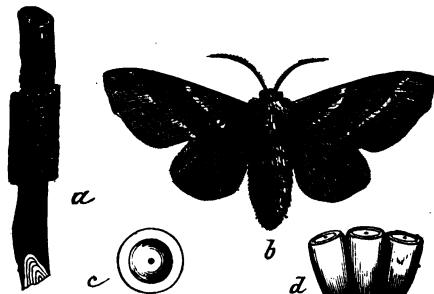


FIG. 22 Forest tent-caterpillar: *a* cluster of eggs; *b* female; *c* top view of an egg; *d* side view of several eggs (after Riley)

The cocoons are spun in June, the brown moth, with darker oblique bands across the wings, flying in July. Eggs in belts incircling smaller twigs are covered with a light brown protective substance, and remain unhatched till spring.

Treatment: remove and destroy the eggs; kill the caterpillars when massed on trunk and limbs, either by crushing or by spraying them with kerosene emulsion or with whale oil soap solution; spray the foliage of infested trees with poison; collect and destroy the cocoons.

31 Pigeon Tremex (*Tremex columba*). The large, four winged, brownish adults marked with yellow, frequently known as "horn tails", are usually found in July around diseased and dying tree trunks. The eggs are deposited a short distance within the bark, and the young borers occur near the surface, but full grown ones may make their way to the center of even large trees. This insect is not usually very injurious.

Treatment: cut and burn badly infested trees.

32 Lunate long sting (*Thalesia lunator*). A magnificent brownish, wasp-like insect, with yellow markings and a

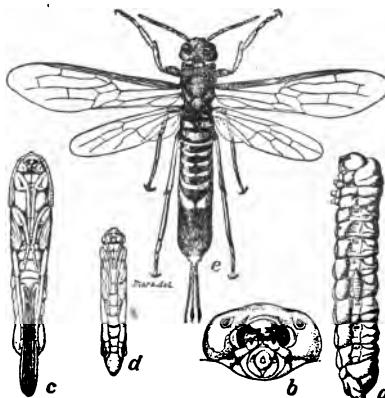


FIG. 23 Pigeon Tremex: *a* larva showing the Thalesia larva fastened to its side; *b* head of larva; *c* female pupa; *d* male pupa; *e* adult female (reduced after Marx)

slender ovipositor or "tail" 2 to 4 inches long. It frequents elms and maples infested by the pigeon Tremex, and occasionally is found with the ovipositor stuck in the wood. The characteristic attitude of this parasite when forcing its long ovipositor into the wood is well shown in the accompanying figure. The white legless grubs attach themselves to the borers and suck their life out. *This insect should therefore be protected.*

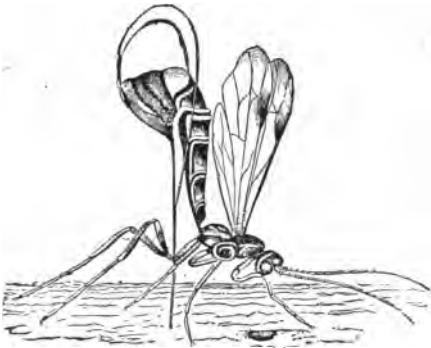


FIG. 24 Lunate long sting ovipositing

33 **Cottony maple tree scale insect** (*Pulvinaria innumerabilis*). The under side of smaller limbs of soft maple are

sometimes festooned with this cottony insect, though more frequently it occurs in small masses. The young appear in July. Sometimes this insect is very injurious on Long Island and occasionally is abundant in other sections of the state.



FIG. 25 Cottony maple tree scale insect. Adult females on twigs with eggs sacs—natural size (after Howard; U. S. dep't agr., div. ent. bull. 23, n. s.)

whale oil soap solution. Brush or scrape off and destroy the old scales.

34 **Sugar maple borer** (*Plagionotus speciosus*). Diseased or loose bark and exposed dead wood indicate the work of

Treatment: spray young with kerosene emulsion or

this pest. The white, legless, fleshy grubs of this beetle frequently cause serious injury by running transverse burrows just

beneath the bark. The stout, black beetles, about 1 inch long, with bright yellow markings, occur from June to August. They deposit eggs in the bark, and these places become more apparent later through sap flowing from the living tissues gnawed by the grub and producing a discoloration around the wound.

Treatment: burn badly infested trees. Search for places where eggs have been deposited and dig out the young borers in the fall. Protect trees with carbolic soap wash from June to August.

35 **Maple tree pruner** (*Elaaphidion villosum*). Small limbs of maple, oak and other trees nearly eaten off by an insect and dropping in September, usually contain the burrows of this species. The parent of the borer

is a nearly cylindric, brown beetle which usually remains within the fallen twig till the next June.

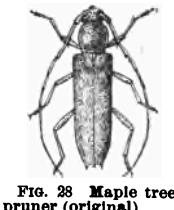


FIG. 28 Maple tree pruner (original)

Treatment: collect infested limbs on the ground and burn before spring.

36 **Elm leaf beetle** (*Galerucella luteola*). Irregular round holes are eaten in young foliage, followed by the grubs gnawing the under portions of the leaves, which then dry and



FIG. 27 Injury produced by a transverse burrow of borer in a sugar maple about 18 inches in diameter

turn brown. The yellowish, black striped beetles, about $\frac{1}{4}$ inch long, appear in early spring and lay eggs in May. The grubs feed in June, changing to yellow pupae the latter part of the month. A second brood occurs in July and extends into September. Known to occur in this state on Long Island, in the Hudson river valley north to Schuylerville, and in a few places in western central New York. This pest prefers European elms, but when numerous will seriously injure American elms.

Treatment: spray the young foliage of infested trees with poison early in May to kill the beetles. The spray *must be thrown* on the *under surface* of the leaf in order to kill the grubs. Kill larvae and pupae on and near trunks of the trees either with hot water, with kerosene emulsion or by sweeping up and burning.

37 Spiny elm caterpillar (Euvanessa antiope). Large black, red marked, spiny caterpillars about 2 inches long may frequently be seen in June feeding on the leaves of elm, willow and several other trees. The parent butterfly is a handsome purplish insect with yellow bordered wings. There are two annual generations in New York state.

Treatment: remove the gregarious caterpillars and crush them or spray the infested limbs with poison.

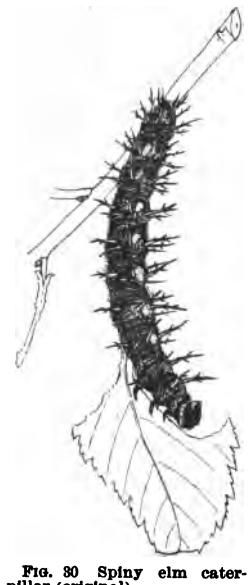


FIG. 80 Spiny elm caterpillar (original)

38 Elm bark louse (Gossyparia ulmii). The adult females in June appear like clusters of small lichens on the under side of the smaller limbs of European elms.

The young emerge in July. This insect appears to be generally distributed in the Hudson river valley, and will probably soon make its way to

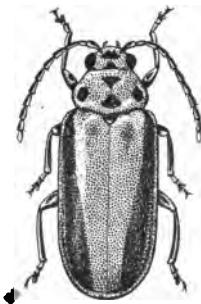


FIG. 29 Elm leaf beetle, adult (reduced from Howard, U. S. dep't agr., Yearbook 1895)

other parts of the state. The draft on a badly infested tree in June is very great; the excretions of the bark lice falling in fine showers keep stones beneath wet even on good drying days. The leaves of infested trees are frequently covered with a blackening fungus, which grows in this secretion.



FIG. 31 Elm bark lice on twig, full grown females (original)

in its inner portions white, flattened, legless grubs, which frequently cause considerable injury. The beetles appear from early May till latter part of June.

Treatment: cut and burn badly infested trees. Protect valuable trees with carbolic soap wash during May and June.

40 Elm snout beetle (*Magdalis barbita*). Thick, fleshy,

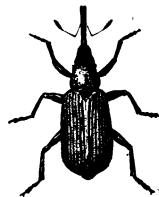


FIG. 33 Elm snout beetle, *Magdalis barbita* (original)

legless grubs working in inner bark of elm. Follows attack by the elm-borer and occasionally is very abundant. The parent insect is a black snout beetle about $\frac{1}{4}$ inch long. It sometimes occurs in large numbers and may have associated with it the reddish, closely allied *Magdalis armicollis*.

Treatment: burn badly infested trees and keep others vigorous.

Treatment: spray the young with kerosene emulsion or whale oil soap solution.

39 Elm borer (*Saperda tridentata*). Diseased or dead bark is usually the first indication of injury by this insect. The tree soon becomes unthrifty and examination of the bark may show

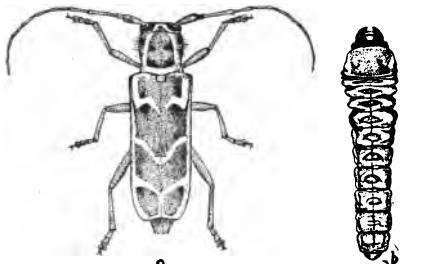


FIG. 32 Elm borer: a adult; b half grown larva—hair line represents natural size of latter (original)

41 Fall web worm (*Hyphantria cunea*). Web tents in July and August inclosing leaves on the tips of branches, the eaten foliage turning brown.

This insect attacks many trees and occasionally is very destructive. The parent insect is a whitish moth.

Treatment: destroy webs and their inhabitants or spray foliage of affected limbs with poison.

42 Bag worm (*Thyridopteryx ephemeraeformis*). Defoliated evergreens and other trees are found infested in late summer and fall with curious caterpillar containing bags of this insect. Occurs in vicinity of New York city and is sometimes very destructive, specially to evergreens. The female is wingless and never leaves the bag.

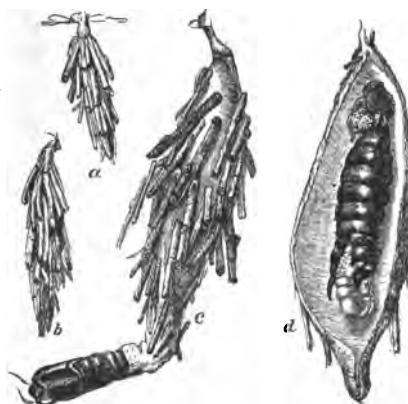


FIG. 35 Bag worm: a, b, c at successive stages of growth; d male bag; e female bag (reduced from Howard, U. S. dep't agr., Yearbook 1895)

made its way about 40 miles north. The parent insect is a white, black or blue spotted moth with a wing spread of about 2 inches.

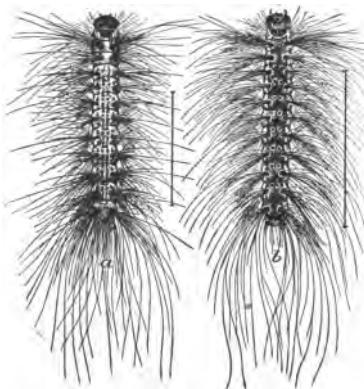
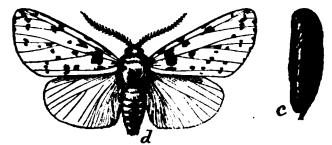


FIG. 34 Fall web worm: a light form of full grown larva; b dark form of same; c pupa; d spotted form of moth (reduced, from Howard, U. S. dep't agr., Yearbook 1895)

Treatment: collect and destroy bag worms or spray with poison.

43 Leopard moth (*Zeuzera pyrina*). The whitish, black spotted caterpillar of this imported pest makes large burrows in trunks and limbs. It attacks most kinds of trees and shrubs grown about New York city, and has already

Treatment: dig out young borers. Kill others by injecting carbon bisulfid in the burrow and then stopping the orifice with putty or soap. Burn badly infested trees.



FIG. 86 Leopard moth, adult female (after Pike)

44 Bronze birch-borer (*Agrilus anxius*). If infested bark is examined, a slender flat-headed grub may be found running burrows in all directions in the inner portions. White and other birches are attacked, one of the first indications of attack being the dying of the tree at the top. It is very injurious at present in Buffalo. The beetles appear in June.

Treatment: cut and burn badly infested trees.

GARDEN INSECTS

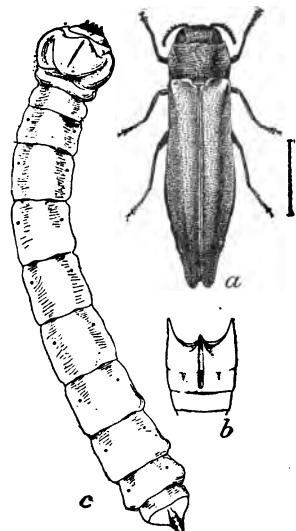


FIG. 87 Bronze birch borer: *a* female beetle; *b* first abdominal segments of male from below; *c* larva from above—all enlarged about $3\frac{1}{2}$ times (after Chittenden, U. S. dept. agr., div. ent., bul. 18, n. s.)

45 Colorado potato beetle (*Dorophora 10-lineata*). Stout yellowish beetles with black striped wing covers appear in early spring, feed, and deposit yellowish eggs in clusters on under surface of leaves. The reddish, black marked grubs also devour the foliage.

Treatment: spray vines with poison; handpicking.

46 **Squash vine-borer** (*Melittia satyriniformis*). Wilting of one or more runners is caused by a whitish caterpillar boring in the stem near the root. The parent insect is a beautiful, clear winged moth with brownish black fore wings, transparent

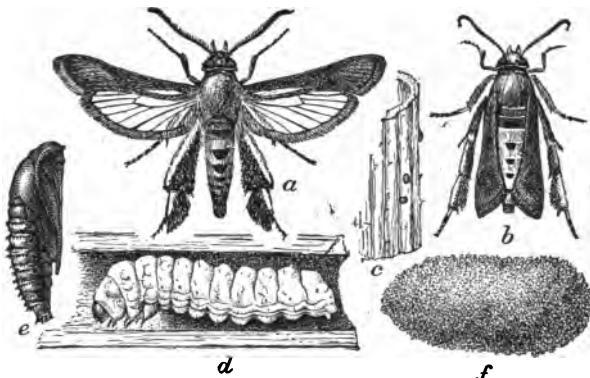


FIG. 38 Squash vine borer: *a* male moth; *b* female moth with wings folded as at rest; *c* eggs on bit of squash stem; *d* full grown larva in vine; *e* pupa; *f* pupal cell—all enlarged $\frac{1}{6}$ (after Chittenden, U. S. dep't agr., div. ent., circ. 38, 2d ser.)

hind wings and with legs beautifully ornamented with black and orange tufts. She deposits eggs on almost any part of the plant.

Treatment: plant a few early squashes as a trap crop, destroying these vines as soon as the crop is secured. Slit the softer, infested portions, remove the borers and cover the wounded part with earth. Protect young plants with netting.

47 **Striped cucumber beetle** (*Diabrotica vitata*). Yellow beetles about $\frac{1}{4}$ inch long, striped with black, occur in numbers on cucumber and squash vines. The slender, whitish, brown headed grubs live on the roots of these plants and frequently cause great injury.

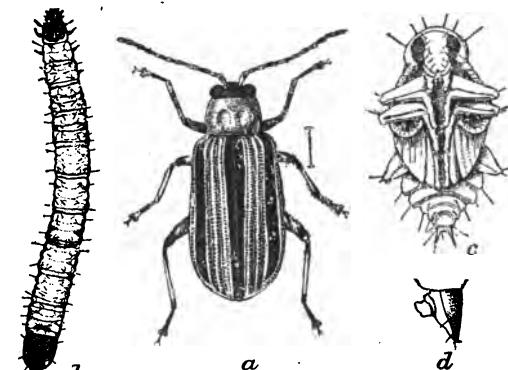


FIG. 39 Striped cucumber beetle: *a* beetle; *b* larva; *c* pupa; *d* side view of anal segment (after Chittenden, U. S. dep't agr., div. ent., circ. 31, 2d ser.)

Treatment: protect young vines with netting. Dust vines with ashes, plaster of paris, etc. Poison trap crop of squash. Clean culture and the destruction of vines as soon as the crop is harvested will do much to keep this pest in check.

48 Cucumber flea beetle (*Epitrix cucumeris*). Brown-

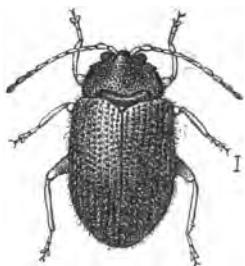


FIG. 40 Cucumber flea beetle, much enlarged (after Chittenden, U. S. dep't agr., div. ent., bull. 19, n. s.)

ish, gnawed spots on leaves made by numerous black jumping beetles about $\frac{1}{6}$ inch long. They are frequently very injurious. The young live on the roots of various plants.

Treatment: spray vines with bordeaux mixture, with poison or with a combination of the two. Dusting the affected plants with plaster of paris, ashes, etc. will also afford some protection.

49 Squash bug (*Anasa tristis*). Wilting leaves with their under surface infested by greenish young or by the large, grayish brown stink bugs about $\frac{3}{4}$ inch long. The eggs are deposited in clusters on the under surface of the leaves.

Treatment: collect and destroy the early appearing bugs. Place chips and similar shelters near the vines and kill each morning the bugs collected underneath. Crush the brownish eggs on under surface of the leaves.

50 Common asparagus beetle (*Crioceris asparagi*). Slate colored grubs about $\frac{1}{3}$ inch long or beetles about $\frac{1}{4}$ inch long, prettily marked with yellow, blue and red, eat the more tender parts of the plants. They breed during the greater part of the growing season. Occurs on Long Island, in the Hudson river valley and in the lake regions of the western part of the state.

Treatment: the daily cutting of producing beds serves to keep

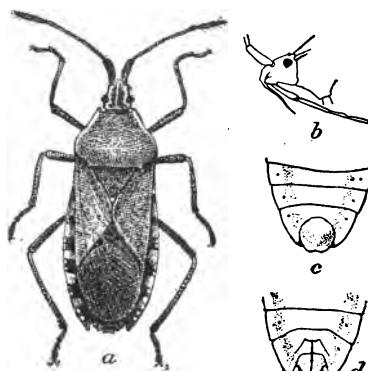


FIG. 41 Squash bug: a adult female twice natural size; b, c and d details of structure more enlarged (after Chittenden, U. S. dep't agr., div. ent., bull. 19, n. s.)

the pest under control then. Young beds and others badly infested after cutting ceases should be sprayed with poison, or a mixture of paris green with plaster or flour should be dusted on the plants while they are wet with dew.

51 12 spotted asparagus beetle (*Crioceris 12-punctata*). Slate colored grubs about $\frac{1}{3}$ inch long or stout, nearly cylindric red beetles about $\frac{1}{4}$ inch long, with 12 black spots, eating the more tender portions of the plant.

Known to occur in the state in several places in the Hudson river valley and in a number of widely separated localities in the western part of the state.

Treatment: same as the preceding.

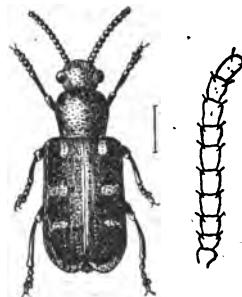


FIG. 42 Asparagus beetle, enlarged about six diameters, with further enlargement of antenna and front tarsus

52 Red headed flea beetle (*Systema frontalis*). Ragged holes and brown spots made by small, jumping,

black, red headed beetles about $\frac{3}{16}$ inch long. Sometimes occurs in large numbers.

Treatment: spray affected plants with poison or with poisoned bordeaux mixture, preferably the latter. Clean culture will do much to prevent attack by this insect.

53 Blister beetles (*Epicauta cinerrea*, *E. vittata*). Feeding in July and August on the foliage of potato and other plants, cylindric, soft beetles about $\frac{5}{8}$ inch long and black and gray, or black striped with yellow.

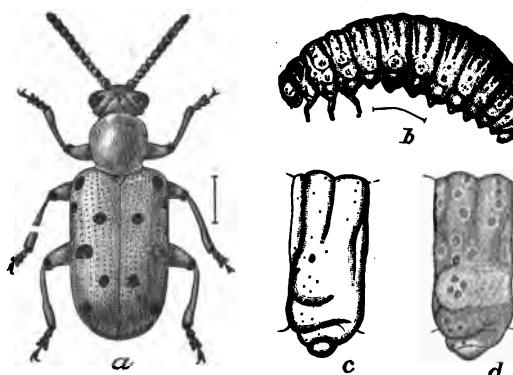


FIG. 43 12 spotted asparagus beetle: a adult beetle; b larva; c, d enlarged segments (after Chittenden, U. S. dep't agr., Year-book 1896)

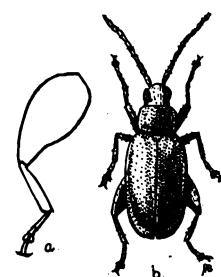


FIG. 44 Red headed flea beetle: a showing leg adapted to jumping—much enlarged, b adult beetle, enlarged (original)

Treatment: as the grubs of these beetles are known to feed on the eggs of grasshoppers and are therefore beneficial, the adults should be destroyed, by spraying affected plants with poison or by beating the insects into pans containing water and kerosene, only when necessary.



FIG. 45 Margined blister beetle, *Epi-cauta cinerea*

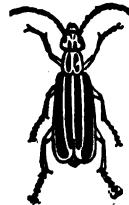


FIG. 46 Striped blister beetle, *Epi-cauta vittata*

54 **Bumble flower beetle**, (*Euphorbia inda*). Brownish mottled beetles about $\frac{5}{8}$ inch long feeding in ears of green corn, attacking peaches, etc. The young are white grubs, and may be found in partially decayed vegetable matter, and the beetles may frequently be seen in the spring flying and making a humming much like a bumblebee. This insect is not usually very destructive.

Treatment: handpicking.



FIG. 47 Bumble flower beetle, natural size: a, b, c enlargements of antenna, anterior leg and posterior leg

may be caused by a brown, white striped active caterpillar, about 1 inch long boring within the stems. The parent is a brownish moth with a conspicuous yellow line near the outer third of the fore wings. This insect attacks many thick stalked, herbaceous plants, and is a difficult one to control.

Treatment: burn the infested stalks before September.



FIG. 48 Stalk borer, moth and caterpillar (after Riley)

57 Variegated cut worm (*Peridroma saucia*). This is a stout, brownish cut worm about $1\frac{1}{2}$ inches long, with obscure markings. It is very injurious to various garden plants. Its operations on carnations in a greenhouse are shown. The adult is an obscurely colored brownish moth.

Treatment: place poisoned baits near plants to be protected.

58 Zebra caterpillar (*Mamestra picta*). Brilliantly marked black and yellow, red headed caterpillars about

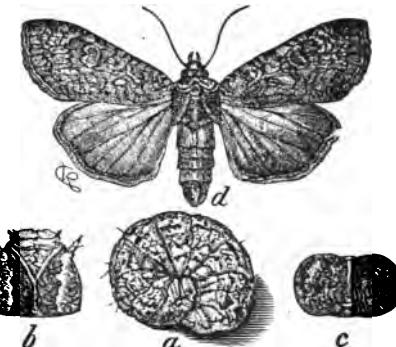


FIG. 49 Variegated cut worm: a larva; b and c segments of the same enlarged; d moth (after Riley)

2 inches long are frequently found on cabbage, beets and other garden crops. These handsome caterpillars are general feeders, and occasionally are found in very large numbers. The moth is marked with deep shades of brown. There are two broods annually.

59 Cabbage butterfly (*Pieris rapae*). The large irregular holes eaten in cabbage by a greenish caterpillar are usually the work of this insect. The white butterflies are frequently very abundant in the field. A common and widely distributed pest.

Treatment: spray affected plants with poison, hellebore or pyrethrum water.

59 Cabbage butterfly (*Pieris rapae*). The large irregular holes eaten in cabbage by a greenish caterpillar are usually the work of this insect. The white butterflies are frequently very abundant in the field. A common and widely distributed pest.

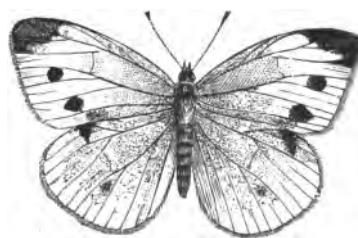


FIG. 51 Cabbage butterfly, female (after Riley)

Treatment: capture the butterflies with nets. Spray young cabbage with poison, older ones with hellebore or pyrethrum water. Dust with lime.

60 Cabbage thrips (*Thrips tabaci*). Cabbage and lettuce frequently show white spots as though blasted, caused by minute yellowish or brown insects. These little creatures are scarcely visible to the unaided eye.

Treatment: spray affected plants at the beginning of the trouble with kerosene emulsion or a soap solution.

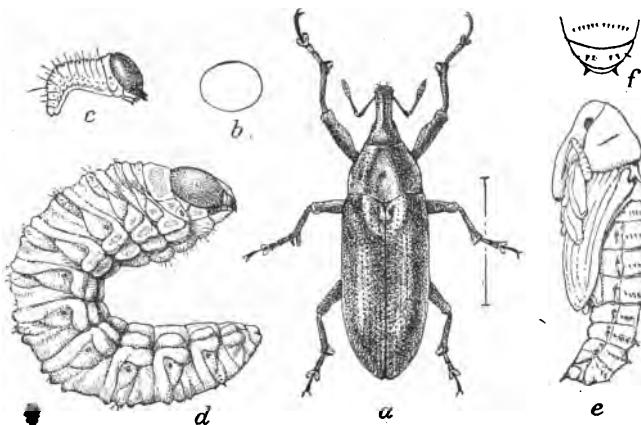


FIG. 52 Rhubarb curculio: *a* adult beetle; *b* newly hatched larva; *c* full-grow larva; *d* pupa—all about twice natural size (after Chittenden, U. S. dep't agr., div. ent., bull. 23, n. s.)

61 Rhubarb curculio (*Lixus concavus*). Wilting rhubarb leaves and punctures in the leaf stems are usually caused by a nearly cylindric, black, extremely "hard shelled" beetle with more or less of a golden bloom on it. The grubs burrow in the stems and leaf stalks of dock as well as of rhubarb.

Treatment: the beetles can be collected and destroyed by hand whenever injurious. They are abroad in June.

62 Tarnished plant bug (*Lygus pratensis*). Small yellowish and black bugs about $\frac{1}{4}$ inch long, frequenting many plants and injuring most garden crops and some trees. A most serious injury by this pest is the extensive blasting of peach buds on nursery stock.



FIG. 53 Tarnished plant bug (after Riley)

Treatment: handpicking or dusting with ashes. Burn all rubbish in the fall.

63 Four lined leaf bug (*Poecilocapsus lineatus*). Bugs about $\frac{5}{8}$ inch long, yellowish, with four black stripes, frequent various plants and injure some considerably. A serious enemy of the currant. There is but one brood annually. The winter is passed in the egg, which hatches about the last of May, the insect being full-grown about the middle of June. The white eggs are deposited in slits made in the wood.

Treatment: dust affected plants with ashes. Spray young with kerosene emulsion. Cut and burn tips of bushes containing eggs.

GRASS INSECTS

64 Army worm (*Leucania unipuncta*). Brownish, white striped caterpillars about 2 inches long devouring grasses and allied plants occasionally appear in immense numbers. There are two or three generations annually in this state, but it is very exceptional that this pest is as destructive as it was in 1896. The parent moth is brownish, with a small white spot on the fore wing. The eggs are laid by preference in tough stalks of rank herbage, such as grows along neglected ditches, etc.

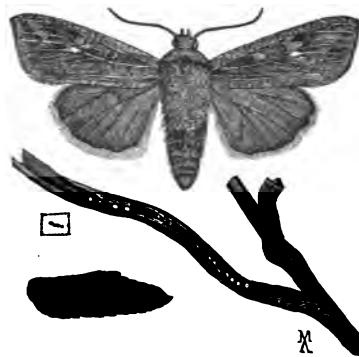


FIG. 54 Army worm: moth, pupa and eggs in natural position in a grass leaf—all natural size (after Comstock)

Treatment: exclude the pests by ditching, or kill with poisoned baits. Prevent their occurrence by clean culture.

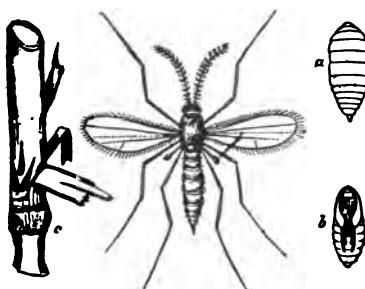


FIG. 55 Hessian fly

65 Hessian fly (*Cecidomyia destructor*). Darker, broad leaves with free stooling, followed by the infested patches turning yellow, are the usual indications of attack. There are two broods annually,

the adults of one appearing in September, those of the other in April or May, the latter being the cause of the lodged grain.

Treatment: late planting in connection with earlier sown decoy strips to be plowed under in late fall. Cut straw high in infested fields and burn the stubble. Clean culture and rotation of crops.

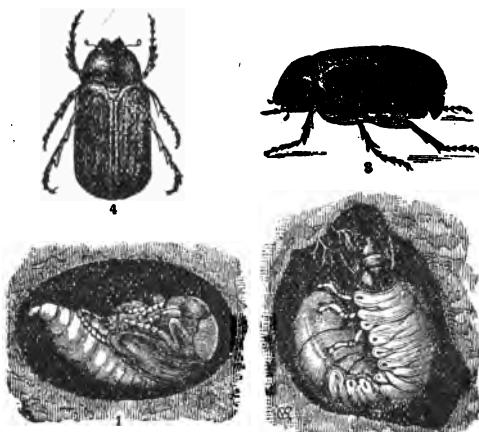


FIG. 56. *Lachnostenus fuscus*: 1 pupa; 2 the white grub in its ground cell; 3 and 4 adult May beetle (after Riley)

brownish beetles or greenish, marked with yellow, in the case of *Allorhina*, which latter occurs in vicinity of New York city. The grub of *Allorhina* has the peculiar habit of turning on its back and progressing by a peculiar undulating motion whenever it travels.

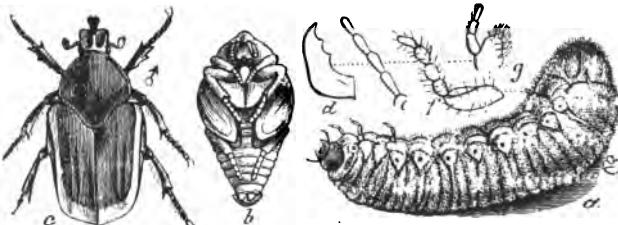


FIG. 57. *Allorhina nitida*: a larva; b pupa; c male beetle; d, e, f, g minor parts of larva magnified (after Riley)

Treatment: spray badly infested areas liberally with kerosene emulsion just before a rain. Dig and destroy the grubs.

66 White grubs
(*Lachnostenus fuscus*, *Allorhina nitida*).
Fleshy, white, brown headed grubs severing grass roots and those of other plants. These pests frequently occur in such numbers as to kill large patches of grass. The parent insects are large

67 Grasshoppers. A number of species attack various crops. Occasionally they occur in very large numbers. The eggs are

deposited in the ground, and are fed on by the young of certain blister beetles.

Treatment: place poisoned baits near crops to be protected.

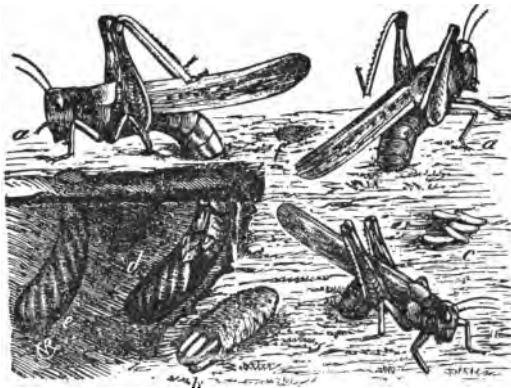


FIG. 58 Rocky mountain locust: *a, a*, a female in different positions ovipositing; *b* egg-pod extracted from the ground, with the end broken open; *c* some separate eggs; *d, e* a section showing an egg-pod placed and another being placed; *f* where a pod has been covered up (after Riley)



FIG. 59 Red-legged locust

HOUSEHOLD INSECTS

68 House fly (*Musca domestica*). Easily recognized as the more common fly around houses. It breeds in manure and

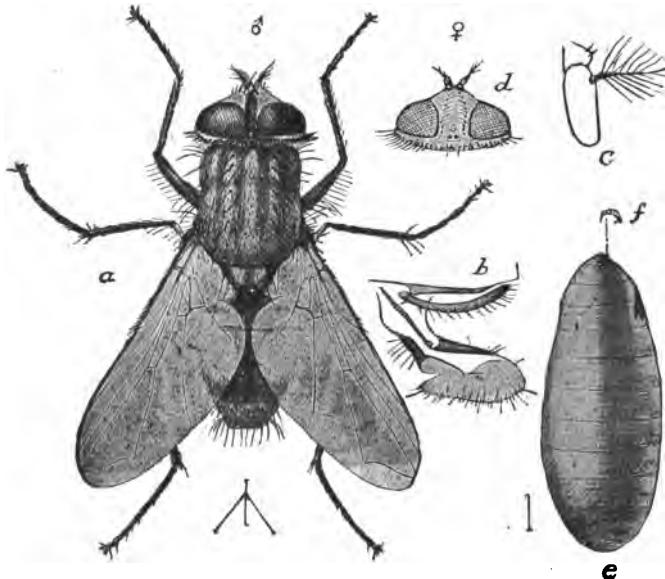


FIG. 60 House fly: *a* adult male; *b* proboscis and palpus; *c* terminal antennal joints; *d* head of female; *e* puparium; *f* anterior spiracle, all enlarged (after Howard and Marliatt, U. S. dep't agr., civ. ent. bull. 4, n. s.)

dooryard filth. One fly may deposit as many as 120 eggs, and under favorable conditions but 10 days are required to complete the life cycle.

Treatment: exclude with screens. As it breeds in manure and garbage, keeping this material cleaned up or inaccessible to flies will reduce their numbers.

69 **Bed bug** (*Acanthia lectularia*). A flattened, reddish, wingless insect about $\frac{1}{4}$ inch long frequenting houses, specially those affording numerous cracks where it can find shelter and where uncleanliness prevails. This disgusting intruder

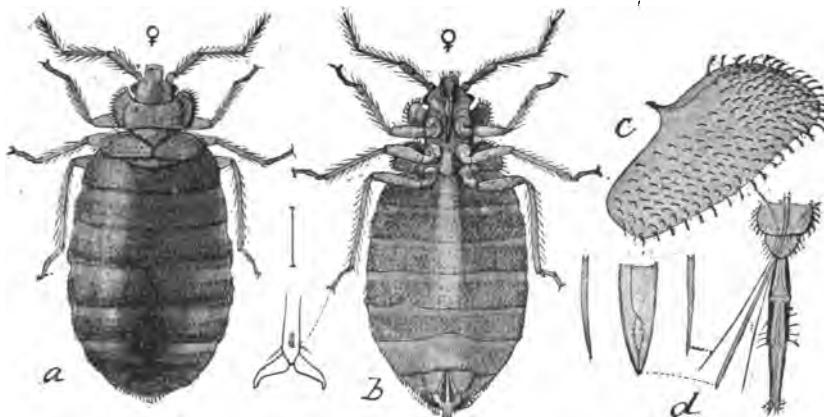


FIG. 61 Bed bug: a and b adult females gorged with blood, upper and under surfaces c, d, structural details (after Marlatt, U. S. dep't agr., div. ent., bull. 4, n. s.)

requires about seven weeks to complete its life cycle. It is able to exist for long periods without food.

Treatment: apply benzin, kerosene, or other petroleum oil to crevices in infested beds. Corrosive sublimate may be used in same manner. Fumigation with sulfur is valuable wherever possible.

70 **Kissing bug: masked bed bug hunter** (*Opisocetus personatus*). A brownish or black insect about $\frac{3}{4}$ inch long. It is attracted by lights, and its young, which conceal itself by a covering of lint, etc. is said to have a partiality for bed bugs.

Not usually harmful, though it can inflict a severe bite or "sting." It is frequently found in or about houses.

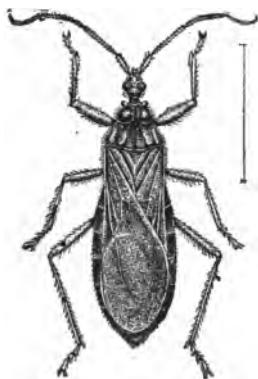


FIG. 62 Kissing bug: masked bed bug hunter, about twice natural size (after Howard, U. S. dep't agr., div. ent., bull. 22, n. s.)

Treatment: screens should exclude it most effectually.

71 **Buffalo carpet beetle** (*Anthrenus scrophulariae*). The larvae are easily recognized by their shaggy appearance, being provided with coarse bristles along the sides and at the posterior extremity of the body. The beetles are about $\frac{1}{8}$ inch long, black, marked with white and down the middle of the back with a red line which widens into three projections. These pretty beetles are very common on flowers, specially spiraea and tulips, and are frequently brought into houses with the blossoms.

Treatment: use rugs or matting in place of carpet whenever possible. Infested carpets should be taken up and sprayed with

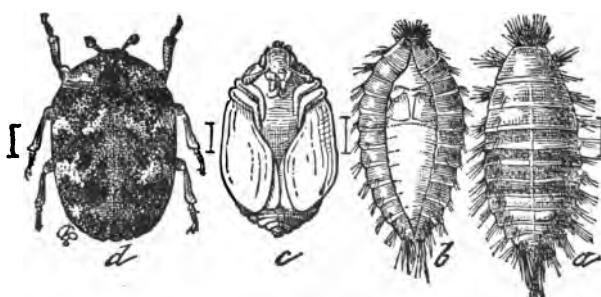


FIG. 63 Buffalo carpet beetle: a larva; b cast skin of larva at molting; c pupa; d beetle—enlarged from natural sizes shown in accompanying lines (after Riley)

benzin, and the cracks in the floor should be filled with plaster of paris before relaying.

72 **Black carpet beetle** (*Attagenus piceus*). The light brown cylindric larva has a long "tail" of slender hairs. The adult is a small oval black beetle nearly $\frac{3}{16}$ inch long. This

species has a decided taste for feathers, though it infests carpets and attacks many other substances. It is quite common in Albany.

Treatment: same as for the preceding.

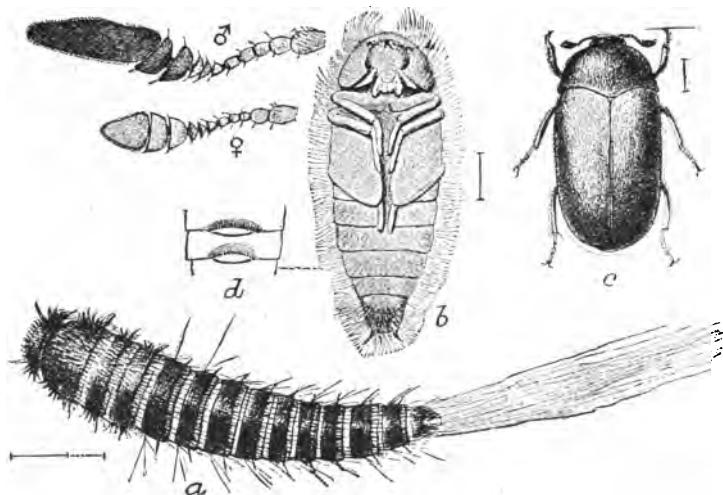
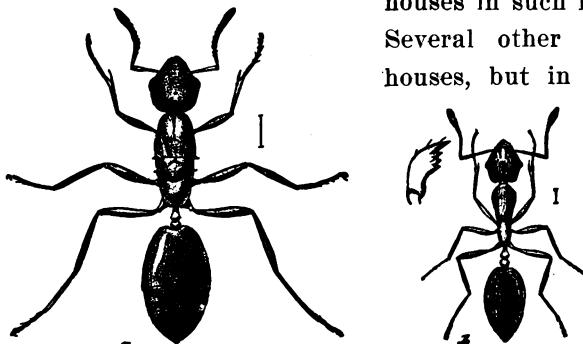


FIG. 64 Black carpet beetle: *a* larva; *b* pupa; *c* adult beetle—all enlarged (after Howard, U. S. dep't agr., div. ent., bull. 4, n. s.)

73 Little red ant (*Monomorium pharaonis*). This is the common yellowish red ant about $\frac{3}{16}$ inch long that frequents houses in such numbers at times. Several other species occur in houses, but in this latitude the



little red ant is the most annoying, as a rule.

Treatment: destroy colony with carbon bisulfid when possible.

This is done by using a broom handle to make holes in the nest a few inches deep and several inches apart, pour-

ing in each about a teaspoonful of carbon bisulfid, then covering the nest with a damp blanket and in a few minutes exploding the fumes collected beneath with a light on the end of a short pole. Attract to sponge filled with sweetened water and kill the collected ants by dropping them in hot water.

74 Cheese skipper (*Piophila casei*). Whitish, jumping

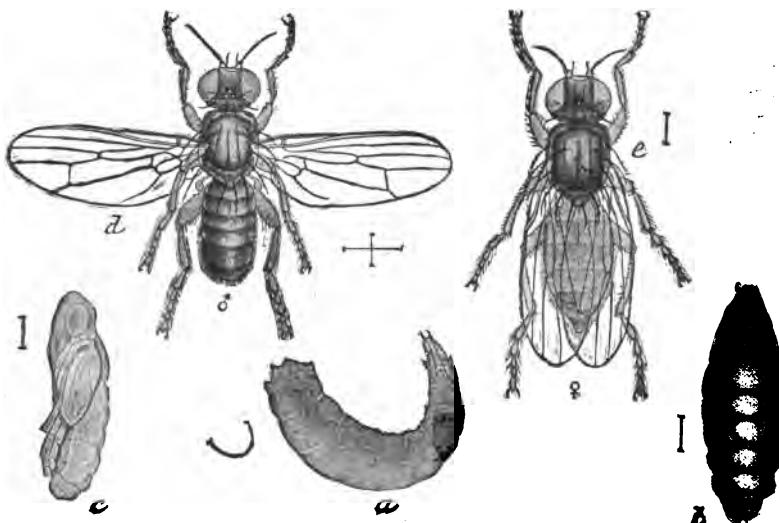


FIG. 66 Cheese skipper: *a* larva; *b* puparium; *c* pupa; *d* male fly; *e* female with wings folded—all enlarged (after Howard, U. S. dep't agr., div. ent., bull. 4, n. s.)

maggots are sometimes found infesting cheese. The parent insect is a small black fly less than $\frac{1}{2}$ inch long. This insect will also attack hams, and occasionally causes serious loss.

Treatment: exclude flies with netting, using 24-to-the-inch mesh. Cleanliness will render cheese factories less inviting to the flies. Hams and cheese stored in darkness are much less liable to infestation.

75 Bacon beetle (*Dermestes larvarius*). A dark brownish beetle about $\frac{5}{16}$ inch long with yellowish band across the base of the wing covers. The larva is brown, hairy, about $\frac{5}{8}$ inch long. Both

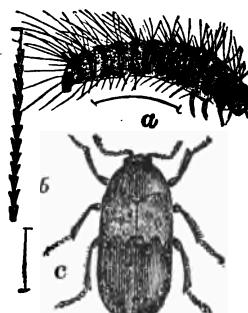


FIG. 67 Bacon beetle: *a* larva, enlarged; *b* larval bristle, greatly enlarged; *c* beetle

adult and larva attack bacon, meat, etc. The life cycle can be completed in about six weeks.

Treatment: cleanliness and excluding insects from the food.

76 **Croton bug** (*Phyllodromia germanica*). This is the smaller, light brown roach about $\frac{1}{4}$ inch long found in houses. It is very prolific, and is the species that is more abundant in cities.

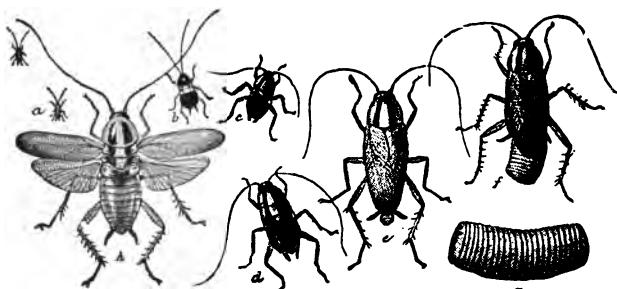


FIG. 68 Croton bug: a, b, c, d successive immature stages; e adult; f adult female with egg case; g egg case enlarged; h adult with wings spread—all natural size except g (after Riley)

Treatment: roach poisons, such as Hooper's fatal food. Paris green with sugar has been used successfully, but is a dangerous poison. Fumigate with sulfur where possible. Entice the bugs to enter vessels partly filled with stale beer from which no escape is provided.

77 **Cockroach** (*Periplaneta orientalis*). This is the larger dark brown species an inch or more long, found in dwellings.

It was much less wary than the preceding form.

Treatment: same as for the croton bug.

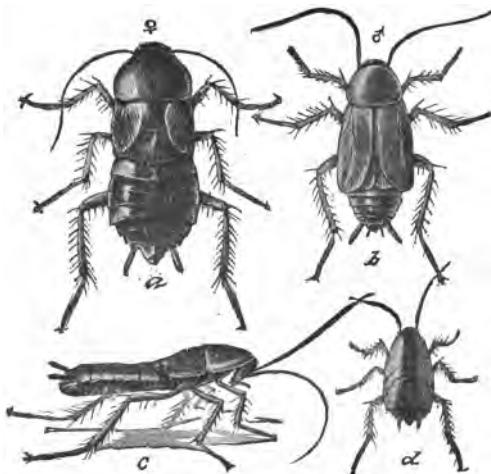


FIG. 69 Cockroach: a and c female; b male; d half-grown specimen—all natural size (after Marlatt, U. S. dep't agr., div. ent., bull. 4, n. s.)

INSECTS AFFECTING STORED FOOD PRODUCTS

78 **Grain moth** (*Sitotroga cerealella*). A small caterpillar about $\frac{7}{16}$ inch long working in various grains and producing a whitish moth with a wing spread of a little over $\frac{1}{2}$ inch.

Treatment: fumigate infested grain with carbon bisulfid, and treat suspected granaries in the same manner.

79 **Saw-toothed grain beetle** (*Silvanus surinamensis*). A small, brown, slender beetle about $\frac{1}{8}$ inch long found infesting cereals and dried food products. A common and prolific species which may complete its life cycle in 24 days, and may produce seven generations within a year.

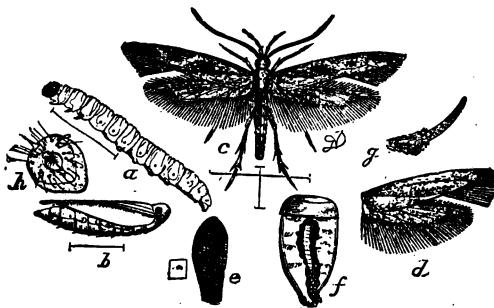


FIG. 70 Grain moth: *a* larva; *b* pupa; *c* moth; *d* wings of a paler variety; *e* egg; *f* kernel of corn showing work of larva; *g, h* other structural details—all enlarged except *f* (after Riley)

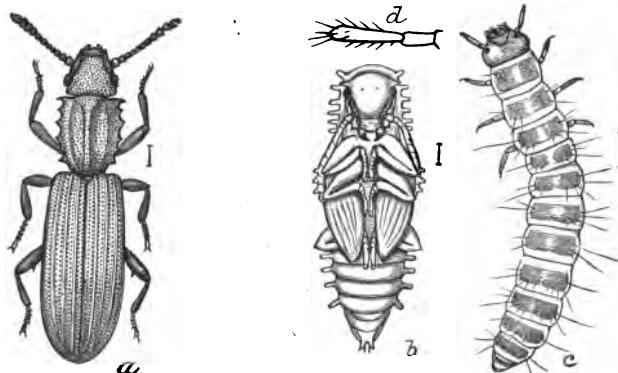


FIG. 71 Saw-toothed grain beetle: *a* adult; *b* pupa; *c* larva—all enlarged (after Chittenden, U. S. dep't agr., div. ent., bull. 4, n. s.)

Treatment: fumigate infested cereals with carbon bisulfid, and allow none of its food to lie long undisturbed.

80 Confused flour beetle (*Tribolium confusum*). A rather stout, shining, reddish brown beetle about $\frac{3}{16}$ inch long which attacks a large number of cereals and cereal products.

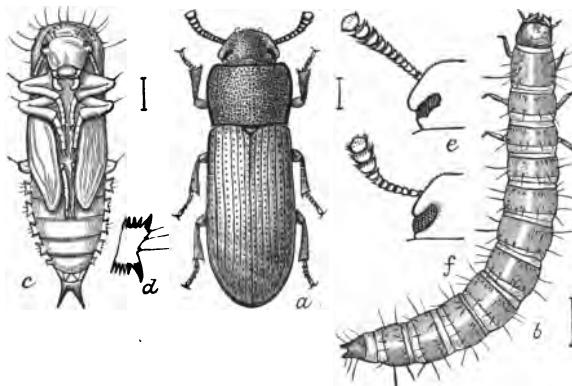


FIG. 72. Confused flour beetle: a beetle; b larva; c pupa—all enlarged; d, e, f minor parts enlarged (after Chittenden, U. S. dep't agr., div. ent. bull. 4, n. s.)

Very prolific, and frequently causes considerable injury. The life cycle may be completed in 36 days, but in cool weather this period is much prolonged.

Treatment: fumigate with carbon bisulfid, and clean infested localities.

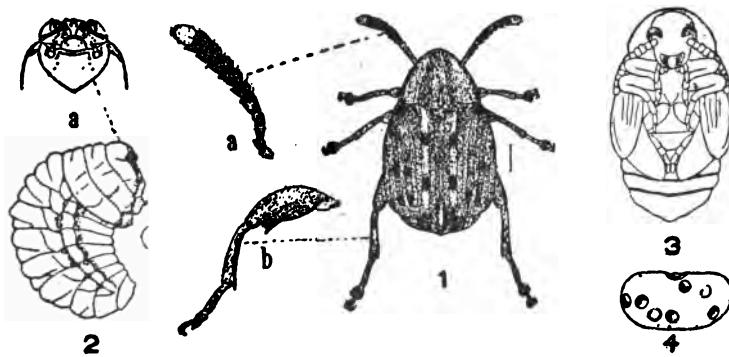


FIG. 73. The bean weevil: 1, beetle; 1a antenna, greatly enlarged; 1b hind leg enlarged; 2, larva, 2a larval head enlarged to show mouth parts; 3, pupa; 4, bean burrowed by the insect

81 Bean weevil (*Bruchus obtectus*). Small grayish brown beetles about $\frac{1}{8}$ inch long breeding in dry beans and eating out numerous holes. This insect attacks beans in the field by

preference, but frequently it will be found riddling the dried, stored beans.

Treatment: fumigate beans in all infested localities with carbon bisulfid as soon as threshed.

82 **Pea weevil** (*Bruchus pisorum*). Brownish or black beetles with indistinct white markings, about $\frac{3}{16}$ inch long, infesting peas. Habits about the same as those of the preceding species, except that it attacks peas.

Treatment: same as for bean weevil.

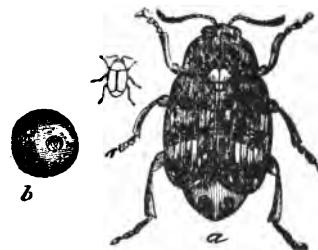


FIG. 74 Pea weevil: a natural size and enlarged; b a pea containing weevil

BENEFICIAL INSECTS

83 **Silk worm** (*Bombyx mori*). One case showing eggs, larva, single and double cocoons, those from which moths have emerged, one from which the silk has been reeled, male and female moths and the raw silk; also several other silk spinners and their cocoons, as follows: cocoons and moth of American silk worm, *Telea polyphemus*; cocoon and pupa of *Antherea yamamai*, a Japanese silk worm; moth of *Antherea pernyi*, a Chinese silk worm; cocoon and moth of *Samia cynthia*, a domesticated silk worm which feeds mostly on the ailanthus tree.

84 **Pollen carriers.** A great many insects convey pollen from flower to flower, and in certain cases there are some very interesting adaptations. Some of the more common pollen-carriers are



FIG. 75 Wasp, enlarged (after Riley)



FIG. 76 Syrphus fly, adult—enlarged

honey bees, bumble or humble bees, other bees, wasps, flower or *Syrphus* flies and many others. The importance of this class of insects and their work is hardly appreciated, yet without their aid it would be practically impossible for us to raise most fruits, simply because no man or group of men would have time to fertilize, in the limited time available for such work, anywhere near all the blossoms which are attended to without previous thought or preparation on the part of man.

85 Lady bugs. Certain species are exceedingly valuable agents in controlling plant lice, which they and their young feed on. The

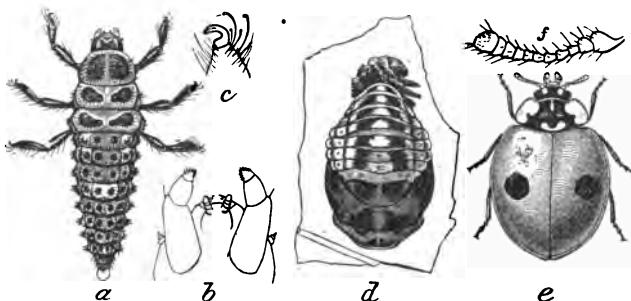


FIG. 77 Two spotted lady bug: *a* larva; *b* mouth parts of same; *c* claw of same; *d* pupa; *e* adult; *f* antenna of same (reduced after Marlatt, U. S. dep't agr., div. ent., circ. 7, 2d s.)

larvae, or grubs, are usually dark colored, marked with yellow, and among hop-growers are known as "niggers." Some forms prey on scale insects.

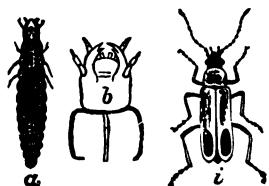


FIG. 78 The Pennsylvania soldier beetle: *a* larva; *b* its head, enlarged; *c* beetle

86 Soldier beetles (Chauliognathus species). These beetles are among the pollen-carriers, and the larvae prey on the worm of the codling moth.

87 Syrphus flies. The adults are usually seen among flowers, but the work of their frequently brightly colored larvae in reducing the number of plant lice is not so well known. These beneficial maggots are somewhat conical in shape, and may be found among colonies of plant lice.



FIG. 79 Larva of a *Syrphus* fly

88 Lace-winged flies (*Chrysopa* species). The delicate green, gauzy winged adults are beautiful creatures. The voracious, active larvae are veritable aphis lions, and may be seen in con-

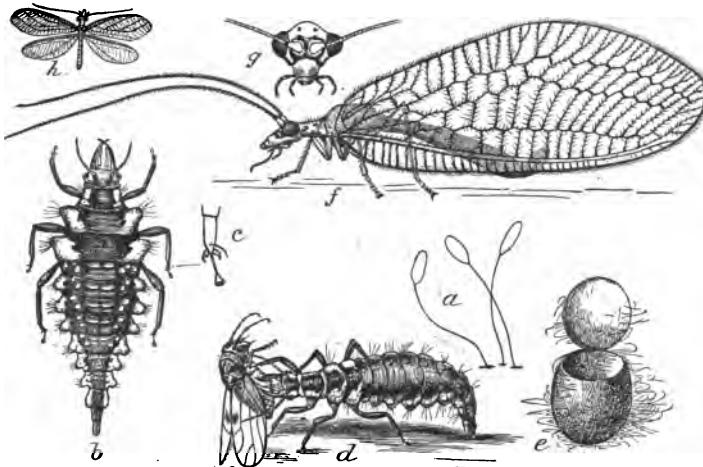


FIG. 80 Lace-winged fly *Chrysopa oculata* Say: a eggs; b full-grown larva; c foot of same; d same devouring a Psylla; e cocoon; f adult insect; g head of same; h adult, natural size (reduced after Marlatt, U. S. dep't agr., div. ent., circ. 7, 2d s.)

siderable numbers on trees infested with aphids. The eggs, curiously placed on the end of a slender stalk, always excite admiration in the beholder.

89 Spined soldier bug (*Podisus spinosus*). Represents a number of species which prey on other insects. This one feeds on a number of common pests, such as the potato beetle, elm leaf beetle and asparagus beetle grubs. One is frequently seen with a grub of the elm leaf beetle or asparagus beetle on its extended beak.



FIG. 81 Spined soldier bug: a beak or proboscis enlarged; b insect with one wing extended

90 Pimpla (*Pimpla conquisitor*). This species is one of the most valuable of the hymenopterous parasites, and represents a large class of parasites which render good service in keeping many pests under control. It was reared

in large numbers from the forest tent-caterpillar this past season, and it preys on a number of other very injurious insects.

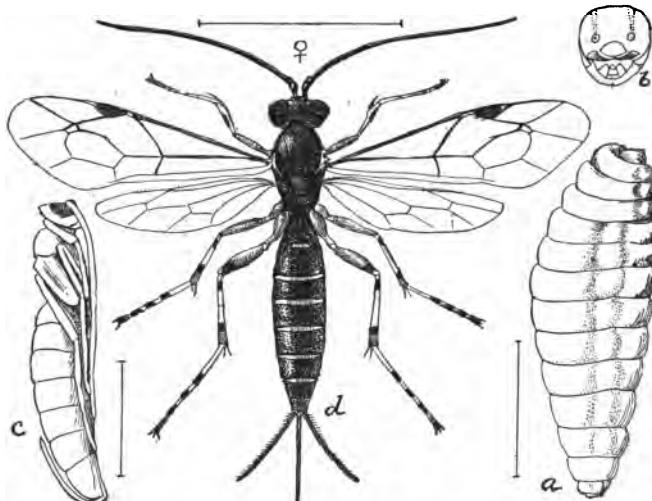


FIG. 82 *Pimpla conquisitor*: a larva; b head of same; c pupa; d adult female, all enlarged (after Howard, U. S. dep't agr., div. ent., tech. ser., no. 5)

91 Red tailed Tachina fly (*Winthemia 4-pustulata*). A most valuable parasite of the army worm, tent-caterpillar and several other pests. This fly has been observed in considerable numbers in fields badly infested with army worms, and is doubt-

less a most efficient parasite in keeping this pest under control.

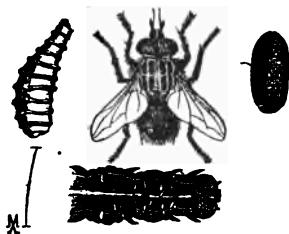


FIG. 83 Red tailed Tachina fly: larva, fly and puparium; also its eggs placed on the fore part of an army worm

used for human food. Much depends on the thoroughness with which the application is made.

Paris green 1 pound, lime 1 pound, water 100 to 300 gallons, or dry 1 pound to 75 of plaster or flour. *London purple* and *paragrene* may be used in the same manner.

FORMULAS

Internal poisons like paris green are used only against insects which devour their food. Place where they must be eaten if the plant is attacked and on nothing soon to be

used for human food. Much depends on the thoroughness with which the application is made.

Paris green 1 pound, lime 1 pound, water 100 to 300 gallons, or dry 1 pound to 75 of plaster or flour. *London purple* and *paragrene* may be used in the same manner.

Arsenite of lime. Dissolve 1 pound white arsenic, 4 pounds sal soda (washing soda, carbonate of soda) in 1 gallon water by boiling in an iron vessel 15 minutes, or till the arsenic dissolves, leaving only a little muddy sediment. Add water lost in boiling, **use 1 pint of this solution to 40 gallons water, to which has been added 2 pounds freshly slackened lime, or add 1 pint of the solution to 40 gallons bordeaux mixture.**

Arsenate of lead. Dissolve 11 ounces acetate of lead (sugar of lead) in 4 quarts water and 4 ounces arsenate soda (50% purity) in 2 quarts of water, each lot in a wooden pail, then add solutions to 100 to 150 gallons water. May be used much stronger without injury to plants, and is unexcelled for use against insects which feed for a considerable time, as does the elm leaf beetle. It will not burn the foliage, even if applied in very large amounts, and will adhere for an indefinite period, in spite of rains. Prepare as directed above, or use one of the paste forms on the market; the latter are better than the dry or crystalline article.

Poisoned baits. Dip fresh clover or other attractive leaves in strongly poisoned water and place in infested localities. 1 pound paris green, 50 pounds bran, sweetened with molasses or cheap sugar, mixed to a soft mash with water is very attractive to grasshoppers. 20 pounds dry middlings, 1 pound paris green, is good for cutworms.

Poison carrier.¹ Heat 1 pint fish oil or cheap animal oil except tallow, 5 pounds pulverized resin in iron kettle with 1 gallon water till resin softens; then add lye solution (1 pound concentrated lye dissolved as for soap); stir thoroughly; add 4 gallons water and boil 2 hours, or till mixture will unite with cold water, making a clear, amber colored liquid. Add water to make 5 gallons. Use 1 gallon of the solution to 16 gallons water, and add 3 gallons milk of lime and $\frac{1}{4}$ pound paris green.

Contact insecticides are effectual only when applied directly to soft bodied insects, and the results will be proportional to the number of insects actually hit with the insecticide.

¹ Recommended by Mr Sirrine for poisoning insects on cabbage.

Hellebore (fresh) 1 ounce, water 3 gallons. May also be applied dry. In the latter event it should be mixed with flour several hours before it is used.

Pyrethrum or *insect powder* (fresh) 1 ounce, water 3 gallons. It may be used dry diluted with flour, and should then be mixed several hours before it is used.

Kerosene emulsion. $\frac{1}{2}$ pound hard soap, 1 gallon boiling water, 2 gallons kerosene, dissolve soap in water, add kerosene and emulsify. Or, for limestone regions, 2 gallons kerosene, 1 gallon sour milk; emulsify. Dilute 4-25 times before using. A 10% mechanical kerosene emulsion may be used in place of either of the above.

Petroleum emulsion. A 20% mechanical emulsion of crude petroleum can be applied to fruit trees just before the buds start without injury, and it will result in killing most, if not all, San José scale, provided the application has been thorough.

Whale oil soap. $1\frac{1}{2}$ to 2 pounds to 1 gallon of water for winter use, 1 pound to at least 4 gallons water for summer use.

Ivory soap. 5 cent cake to 8 gallons water is perhaps the best solution that can be used on house plants for scale insects, plant lice, etc.

Hot water, tobacco in solution or as dust are valuable contact insecticides.

Washes for borers. 1 pint crude carbolic acid ($\frac{1}{2}$ pint refined), 1 gallon soft soap, thin with 1 gallon hot water, stir in acid, let it set over night, then add 8 gallons soft water. Or to a saturated solution of washing soda add soft soap to make a thick paint; this is improved by 1 pint crude carbolic acid and $\frac{1}{2}$ pound paris green to 10 gallons of wash. Or in 6 gallons saturated solution of washing soda, dissolve 1 gallon soft soap, add 1 pint carbolic acid, mix thoroughly, slake enough lime in 4 gallons water, so that when added, a thick whitewash will result, then add $\frac{1}{2}$ pound paris green, mix thoroughly. The latter is probably the best. Valuable only to prevent egg-laying on bark.

Fumigation. Most valuable for young nursery stock and for grains. Cyanid of potassium (98% pure) 1 ounce, commercial sul-

furic acid, 1 ounce by measure, water 3 ounces by measure, these amounts for 150 cubic feet of space; expose trees at least $\frac{1}{2}$ hour. Prepare tight chamber, mix acid and water by pouring acid slowly, stirring frequently, into the water. Use earthen or glass vessels, and drop cyanid into the diluted acid, closing chamber at once. Small fruit trees in orchards can be fumigated under a tent before the buds start, using 1 pound of the cyanid to 100 cubic feet space, without injury to the trees, and this will result in killing most, if not all, the San José scale.

Carbon bisulfid 1 pound to 1000 cubic feet space; place in shallow dishes near *top* of chamber.

These substances are deadly poisons, the acid will corrode or eat many things, carbon bisulfid is inflammable and explosive in the presence of *any fire*. *Handle all with extreme care.*

Insecticide and fungicide. The poisoned bordeaux mixture is a most valuable combined insecticide and fungicide and is rapidly coming into favor. The bordeaux mixture may be prepared as follows: dissolve 6 pounds of copper sulfate (blue vitrol) by putting it in a bag of coarse cloth and hanging this in a vessel containing 4 to 6 gallons of water. For this purpose use an earthen or wooden vessel. After the copper sulfate is dissolved, dilute with water to 25 gallons. Slake four pounds of lime and add 25 gallons of water and then mix the two and keep thoroughly stirred while using. When applied on peach foliage, it is advisable to use an additional 2 pounds of lime. To each 50 gallons of bordeaux mixture as prepared above, add four ounces of paris green, london purple or paragrene. The amount of arsenite of lime solution to be used with bordeaux mixture is given on page 45. Arsenate of lead can also be used in the same amounts with this fungicide as with water. Bordeaux mixture alone is an excellent substance to apply to plants attacked by flea beetles, and when poisoned, forms one of the best general purpose sprays.

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